

Persons in the shadow: Assessing the social context of high abilities

HANS GRUBER¹, ERNO LEHTINEN², TUIRE PALONEN² & STEFAN DEGNER^{1,3}

Abstract

From a perspective of research on expertise we argue that the analysis of practice and of the growth of social networks is a promising approach to assessing indicators of high ability. Both groups of variables jointly predict how subjects master critical changes or transitional periods in their careers. Although expert performance is frequently an individual matter, the development of expertise crucially depends on the presence of "persons in the shadow" who design practice patterns, direct the subjects' deliberate practice, and motivate them (often extrinsically). We present detailed analyses from the cases of highly successful professionals – a jazz guitarist, a consultant and a scientist – in order to show how individual and social aspects are combined in early expertise development. Thus, these aspects form the crucial components which have to be considered in the assessment of high abilities if an expertise approach is taken.

Key words: Assessment, Case study, Deliberate practice, Expertise, High ability, Persons in the shadow, Social network

¹ Prof. Dr. Hans Gruber, Institute of Educational Science, University of Regensburg, 93040 Regensburg, Germany; email: hans.gruber@paedagogik.uni-regensburg.de

² Faculty of Education, Turku University, Finland

³ School of Music, Würzburg, Germany

Introduction: High ability = expertise?!

Recently it has been argued that research on expertise and expert performance is a promising approach to investigate high ability (Ericsson, Roring, & Nandagopal, 2007). Experts are persons who, by certain criteria and over time, consistently show superior performance in typical activities related to a professional domain. Their high abilities are often illuminated by comparison with individuals with limited performance, called novices. In contrast to giftedness, expertise comprises highly domain-specific knowledge and skills acquired through practical experience. Thus, innate abilities only play a minor role compared to performance abilities.

Instead, individual cognitive components of expertise, such as memory and knowledge, are focused. There is convincing evidence that inter-individual differences in such components are acquired rather than innate (Ericsson, 1996). But although expert performance often is individual in nature, expertise is situated within a social context, and so is high ability. Individual strength and group acknowledgment are intrinsically related: Skillful people "become" experts through translating and integrating their knowledge into popular meaning systems (Walter, 2004). Other members of the social system guide them during (and often are the driving force behind) the acquisition of expertise. This social aspect affects the assessment of expertise and, thus, of high ability.

One aspect is that few domains offer the opportunity of clustering individuals explicitly in groups, differing in their level of expertise, without social recognition. Even "objective" measures like the Elo rating system in chess are artifacts created through social interaction. In many domains, the identification of experts is based on peer nominations or professional position (Berliner, 2001).

In this paper, however, we focus on a very different aspect, which is not merely methodological in nature, but rather an intrinsic part of the theoretical analysis of expertise and high ability.

Ericsson et al. (2007) argue that superior reproducible performance of experts generally emerges after extended periods of deliberate practice, thus limiting the impact of innate talents. Deliberate practice is practice that aims to develop one's performance level beyond the current level (Ericsson, Krampe, & Tesch-Römer, 1993). The improvement of specific components is addressed in order to refine the related activities. Such experience is neither mindless drilling nor joyful and is not conformable with definitions of intrinsically motivating activities. It is not trivial to decide which (parts of) components are candidates for forthcoming deliberate practice, and individuals rarely spontaneously engage in deliberate practice. Usually there are persons who define the direction of practice and who guide (and enforce) subjects during practice.

Other persons play a critical role in designing practice activities, setting the goals for practice, motivating (often: forcing) individuals to engage in practice, breaking down complex performance into smaller units to be practiced, etc. Such persons are trainers, coaches, teachers, mentors, or parents (Lehmann & Gruber, 2006). A few studies have pointed to the important role of particular social contacts for the long term development of individuals in expertise research (Mieg, 2006) and in high ability research (Sosniak, 2006).

We argue – counter-intuitively to prior research – that the acknowledgment of the presence of such persons has to be an integral part of the assessment of high ability as a predictor of future development. We suggest that the assessment of high ability should include both

components of expertise development, (a) the nature and availability of social contexts, which provide the direction for deliberate practice, and (b) the individual commitment in deliberate practice and acquisition of knowledge and skills.

A problem arises because the other persons often remain in the shadow, mainly serving as facilitators of expert careers. Yet, we argue that their role is underestimated. Although they are not distinguished by bright performance, they set the standards of deliberate practice for the bright experts, they decide the next steps to be trained and improved during the acquisition of practice, they often take part in experts' superior performance (e.g. in sports, music, or science) and they thus contribute to excellence. The presence (or absence) of the appropriate persons in the shadow might well influence whether or not an individual engages in 10-year long deliberate practice within a domain. Our model of the development of high abilities thus brings together individual cognitive components of expertise and the nature and quality of experts' social networks. In three studies, we illuminate where and how the standards for deliberate practice emerge. This in turn helps us to better understand how to educationally support individuals on their long way from novice to expert (Boshuizen, Bromme, & Gruber, 2004). The studies were conducted in different professional fields – jazz music, human resource consultancy and science – which require different research approaches. The assessment of high ability in these studies is based on retrospective interview techniques, document analyses and social network techniques. The common background of the studies is presented in the next paragraph.

Methods for assessing high ability

Retrospective semi-structured face-to-face interviews, tools developed by social network analysis researchers and documents (e.g. diary, curriculum vitae) are integrated in the studies reported below in order to analyze how individual attributes of excellence and social context variables co-variate as parts of the development of high ability. Because we understand high ability as professional expertise, the focus in both groups of variables is on the professional context. The domains considered in this contribution – jazz music, human resource consultancy and science – share the common trait that the expert practice usually does not start at a very early age. Thus, the main concern is focusing on teachers, colleagues, and some sort of audience (e.g. clients or constitution of the field).

Retrospective analyses trace life experiences even though they are not biographical studies as such, and they do not rely on standard biographical material. Retrospective interviews support a long term perspective on the development of high abilities. In many recent expert studies, experts (e.g. musicians and athletics) have been asked about their daily or weekly practice, its level, time spent on practicing alone, practice with others and so on, and this has been shown to correlate with their performance (Cote, Ericsson, & Law, 2005). Diaries and observation studies indicated similar results and correlated with these techniques. These studies indicate that not only the duration of practice is different but also the structure of different forms of training varies along developmental phases during the expert career. However, no standardized method with high validity and reliability has been developed to study life-long expert performance. Cote et al. (2005) emphasize how important it would be to develop tools to study changes taking place in longitudinal analysis. They propose a detailed retrospective interview procedure to trace this information, indicating that different phases in

the expert career can be traced in retrospective analysis even years or decades later. According to their understanding, the more detailed questions help the respondents to recall more accurate episodes and events than would be possible by only asking general questions. In addition, asking very detailed questions makes it possible to verify the answers later.

As for studying the highest abilities, the importance of social context has been found from at least three factors: (1) distinctive family background, (2) education and training, and (3) socio-cultural context. The last two of these are not explained at all by innate talents, but rather by nurturing skills along with practice in the context. It has become evident that genius and talents are not randomly distributed across space and time but they are clustered and focused on some hubs, or historical periods (Simonton, 2006).

We have traced the social context of expertise, i.e. important supporters and teachers to certain periods in their lifespan. By collecting this information, we are able to distinguish the most important steps of their expert development and see the relevance of social dimension to this development. It is expected that especially the social relationships which are maintained regularly (e.g. friends, important teachers, colleagues) can be well retained. If needed, the people belonging to the closest social circle, such as coaches, family members or friends, might validate the information gathered. In some domains, the parents, coaches or teachers have often kept practice logs for a long time of the development which offer very detailed information and reliability concerning training (Cote et al., 2005). High performers are often lifetime exercisers.

There is evidence found in a wide range of retrospective studies that people who have shown high abilities, almost always have studied with a master teacher who has been an outstanding actor in the field and who has helped and supported others. This working pair of a promising student and an excellent teacher has been a basis for self-selection and selective recruitment, even for academic institutions. Studying how they find each other would be a challenge for the future (Sosniak, 2006).

The nature of the three domains requires that the studies do not only include identical methods (retrospective interviews, analysis of curriculum vitae), but also different specific tools. Calendars and practicing calculation was in study 1 (jazz music). In study 2 (human resource consultancy), social network analysis techniques (advice size, egocentric measures) were used. In study 3 (science), citation count, number of articles in highly cited journals, and the technique of name generator were used.

Study 1: Case GP - high ability in the domain of jazz guitar music

The domain: High ability in jazz music

In jazz music, there are larger inter-individual differences in institutionalized education than in classical music. Different approaches prevail, be it a focus on self study versus university study, on taking lessons versus informal sit-ins, or on concentrated practice versus great amounts of live playing.

Accordingly, there is some variance in how jazz guitarists define by themselves what kind of expert they want to be. Different fields of high ability are improvisation versus preparation of musical material, improvising sophisticated melodies and their placement versus accurately playing fast but rhythmic stable eights and sixteenth notes, and so on. The

nature of deliberate practice and the role of persons in the shadow for the development of high ability are quite different for these different fields of jazz music. Thus, objective correlates of expertise are not undisputed in the domain; variables such as "the number of records sold" or "forums at which the artist was invited to play" (both are rather good measures of expertise in classical music) do not necessarily reflect high ability but rather popularity, because the domain of jazz music is much more dependent on economical forces than classical music, which is subsidized by the government. The involvement of persons in the shadow might be useful in jazz music in particular, because fellow musicians are the persons who know the performance itself as well as the desired performance goals of their colleagues. If rich information about and from these persons is considered, the criticisms concerning (simple) peer nomination as the method for the assessment of high ability (Ericsson et al., 2007) can be overcome.

Deliberate practice in jazz music is different in some respects from classical music (Lehmann, 1998), but meets the basic features. In particular, a great amount of laborious training activities over vast periods of the career is required. Degner, Lehmann, and Gruber (2003) report that expert jazz guitar players spent more than 40 hours per week in deliberate practice activities during their time at the music academy. In contrast to classical music, however, jazz guitarists usually start their instrumental training relatively late, and frequently they lack institutional support in the beginning. This does not fit with the findings in studies on deliberate practice in general. It can be concluded that the role of deliberate practice and of persons in the shadow has to be analyzed domain-specifically, if an appropriate assessment of high ability is to be developed. In jazz music, the relevant others are even more "in the shadow" than in other domains. The relationship between teacher and student in jazz music does not fit well into the picture of effective and formal teaching prominent in educational sciences (Berliner, 1994; Gruber, Degner, & Lehmann, 2004).

How to assess high ability in jazz guitar music

Retrospective semi-structured face-to-face interviews were conducted with a large sample of jazz guitarists in order to gather data in order to capture the potential variability of education, of deliberate practice, and of the role of persons in the shadow (Degner et al., 2003). One case subject, GP, is described here in detail.

During the interview, a "biographical time table" was used showing the age of the subject on the Y-axis and biographical variables such as "school and education", "music study", "taking lessons" on the X-axis. As much biographical information as possible, was written into the time table to support visual imagination of biographical and developmental aspects.

Our contribution is not the first case study in jazz expertise. Sloboda (1991) presented a study about the jazz singer and trumpet player Louis Armstrong. He argued that single case studies are well suited for the investigation and understanding of high ability in this field.

The case GP

The case reported in this paper meets all available criteria of high level performance in jazz guitar playing. He is a teacher at two different music universities in Germany. His ex-

expertise was repeatedly confirmed by juries of experts, and he is mentioned in references from established international jazz artists. He produced many highly esteemed recordings together with other international artists. He was honored for his musical excellence by the government of Bavaria (Southern Germany) with the "Bayerischer Staatspreis".

GP began playing the guitar at the age of 14 and made the decision to become a professional at the age of 17. From this day forth he practiced approximately 28 hours a week, although he mentions that only 10 hours of this amount would have met the criteria of a concentrated goal directed activity. He started to play jazz at the age of 20 which was also the starting point for receiving his first lessons from professional teachers at the "Munich Jazz School". At the age of 24, GP took up studies in jazz guitar at the university, but left the university only half a year later. Up to his mid twenties GP spent about 50 hours per week in intense practice activities:

"I don't know what the possible maximum number is, but within these 2 years I did not do anything else than practicing. From morning to night there was just music. Afterwards I was going to concerts or played at sessions."

At the age of 28, GP was invited by Attila Zoller - one of the world's most famous jazz guitar players - to participate at his annual jazz guitar summer workshop in Vermont. Later on, GP was invited to tour with many well-known international artists. He has released more than 25 CDs and has been honored with prizes. He is teaching jazz guitar at different universities across Europe and became the successor for Attila Zoller at the Vermont workshop after Zoller died.

As deliberate practice is, per se, an exhausting and inherently not enjoyable activity, children, much more so than adults, need a lot of influence from physically present mentors or other people. For jazz experts, the period of integration of deliberate practice activities in one's daily routine is far less dependent on other people. The tremendous role of teachers is different, but they nevertheless are responsible to a large degree for the individuals' engagement in practice activities and thus play an important role for assessment of high ability.

In GP's career, two persons were most important for the shaping of his practice habits and social networks, thus mediating his performance outcomes. The first one was Costa Lukacs, a Hungarian guitar player, whom GP met in his early twenties. GP reports that he only took two lessons from Lukacs. They soon became friends, so that their meetings no longer fit the criteria of formal lessons. The second person was the above-mentioned Attila Zoller, who invited GP to his annual Vermont workshop, which many consider to have been a springboard for the careers of many jazz guitar players. The interview revealed substantial differences in the behavior of these two persons in the shadow. This let us distinguish two kinds of persons in the shadow, one fitting into the image of a supportive teacher and facilitator, the other being a motivator through rather anti-pedagogical means.

Bright persons in the shadow: Great teachers

GP studied with some well-known jazz educators at the "Munich Jazz School".

"I have done a lot of ear-training and I intensively studied harmonics. That was even better than studying at Music University. I remember that great instruction of Joe Haider that has always been in actual step with practice or Joe Nay who has been teaching rhythm. That was really great."

These educators provided GP with formal knowledge which he lacked after his years of self-study. The teachers knew exactly which shortfalls had to be eliminated. Attila Zoller also took on the role of a supervisor by defining what had to be done next. It was Zoller who pushed GP towards a more individual kind of playing and improvising although that was not apparent to GP. By now GP reports:

"In the long term Attila of course was right. Too much of imitation is not wise. Most of the listeners do not recognize that but the ones who do might be the important ones. That is in particular true for the American listeners and musicians. You can think of it as a necessity to have your own voice if you want to be part of the American scene."

GP further points out that it was Zoller from whom he got some kind of musical overview, because Zoller fostered GP to adopt a more philosophical point of view about jazz and the art of improvisation. That is in accordance with findings of Berliner (1994) for the American jazz society. Similarly, Lehmann (2006) stresses the tremendous knowledge that teachers have accumulated over their career and are willing to share with their students.

The relation with bright persons in the shadow shaped GP's social network ties, which are suggested to be used as predictors for future performance outcomes:

"I am so glad that I have become acquainted with all that original jazz stars and that I got the chance and the pleasure to play with them. At that time in the eighties I was surrounded by an international jazz scene. That was great. (...) The jazz scene that makes fun does not exist any more. Till this day I have lots of connections and friendships with the people I have met at that time. They gave me enormous power. That was learning on the street."

Through his network ties, GP got access to session playing and could further his own development. Thus the persons in the shadow play an important role by inviting or sometimes even forcing their students to attend sessions with other musicians.

Dark persons in the shadow: Anti-heroes and their mediating role in the development of high ability

Zoller was not only a gentle teacher, but was known for his rude behavior. He was apt to bawl out on his students if they did not behave the way he wanted them to. Refusing his invitation to enter the stage to play at the session ended in rebukes. He used to say:

"If I say 'Play', you have to play. You have to practice another 10 years, before you are allowed to say 'No'".

GP also was rebuked when playing phrases of other musicians or at least phrases which were associated with these musicians. At this point of his career GP learned from his mentor, how important it was to personalize his style of playing. This period seemed to have been critical in the relation with Zoller. On the one hand, self-responsibility and one's own style was required, on the other hand the person in the shadow was the one who strictly asserted his solution about when or what to learn. Although GP at that time was already a well-known expert, it was Zoller who clearly defined the next step.

GP was also rebuked and frustrated by the second important person in the shadow at an earlier point of his formative years when he was about 20 years old.

"At that time I took my first lesson with Costa Lukacs. I was completely finished off. There was nothing that in his opinion I did right. I even should hold the pick in another

manner. But one year later – I really took to heart what he said and did some practice – we met again and everything was ok. I do not know why. Somehow he liked the way I was playing and so I got some kind of a special position and we became friends."

This description is not at all in accordance with the picture of a professional teacher who is supportive in nature. GP in fact reported no hint that Lukacs's reaction resulted from pedagogical reasoning. Nevertheless, it substantially impacted GP's learning. The motivation to continue practicing and learning, however, obviously was present despite Lukacs's intervention. The relation with Lukacs developed quite unexpectedly:

"I did not take lessons any more. Costa sometimes called me just to say: 'Listen to this.' And then he started to play through the telephone. I got to his flat and spent hours just sitting in front of him watching and listening to his playing. All the time he played that crazy music, all these crazy fingerings. I was played down. When I was coming home after hours, my head smoked and I was completely finished. I thought I could not do anything appropriately. But sometimes I could extract some ideas of his playing and I always tried to remember it and to practice these ideas."

Lukacs was far from being an idol in any sense except musically. He never managed to get regular jobs, had financial problems, was seriously drinking and smoking, and missed sessions or came in too late. Nevertheless, he was successful in defining learning goals and demonstrating the possibilities of the instrument.

Persons in the shadow: Whom do they select, and by whom are they selected?

Trying to assess high ability, selection processes play an important role, because they constitute the relation between the individuals and the persons in the shadow. Selection is a mutual process, because on the one hand, the persons in the shadow select their pupils, on the other hand, the pupils try to select their teachers.

GP was invited by Zoller to participate at the Vermont workshop. Zoller was famous for his effective choice of young guitar players, and only the most promising players were honored to participate in his workshops. Further investigation of former participants of the jazz summer camp in Vermont results in a who is who list of jazz guitar experts. This stay in Vermont made a huge impact on GP's practice activities and also set new goals by his being integrated in a community of expert practice, e.g. when playing duets and sessions with international jazz stars.

Today young jazz guitar players tend to study jazz in music universities. In Germany, between 20 and 30 candidates apply for each study place in music universities. Thus, the professional progress is highly selective. Little is known, however, about the validity of the selection criteria applied.

On the other hand, high ability also reflects relevant selections made by learners choosing the right teachers or idols at the right time or attending laborious and intense training methods that only the more accomplished players are willing to engage in.

Selections refer to the listening of recordings of famous jazz guitarists as well as to the choice of teachers. More evidently than in classical music, in the domain of jazz guitar music, the role of the persons in the shadow is to some part virtually taken over by recordings of famous musicians. This means that jazz guitar students are listening, transcribing, playing, analyzing and adopting music from records. Until the mid-1960s it was common to exclu-

sively learn from recordings. Even after institutionalized forms of jazz learning grew, many experts still learn a lot by practicing in this "old-fashioned" way (Degner et al., 2003).

Summary: Development of high ability in jazz music

Analyzing the role of other musicians and teachers for the development of an expert jazz guitarist, the study of case GP showed how persons in the shadow provide exceptional conditions and exceptionally supportive social contexts in which huge amounts of deliberate practice emerge and contribute to the development of expertise. High ability is created along transitions, changes and new network ties. GP spent huge amounts of time in jamming, rehearsing and playing at sessions so that his increasing expertise was accompanied by a growing amount of contacts and was honored by fellow musicians who invited him to play with them at sessions. Thus, individual components of excellence and the growth into a professional network mutually contributed to the development of high ability.

Study 2: A case from human resource consultancy - high ability and the development of professional networks

The domain: High ability in consultancy

The domain of human resource consultancy is shaped by team work. High ability is represented by performance of a group of individuals rather than by individual performance. However, individual ability is the base of group ability. The personal network study approach is appropriate for the analysis of high ability in this domain because it links the social context to individual capacity by indicating how people create, maintain, cultivate and activate their personal social networks. Experts nurture and profile their own expertise by reactivating and strengthening relevant links, depending on what kind of work they are doing (Nardi, Whittaker, & Schwarz, 2000). The research on social networks, especially, stresses the importance of cross-boundary analyses of workplace networks and even experts' past relationships in their former networks (Gruber, Palonen, Rehrl, & Lehtinen, 2007; Hakkarainen, Palonen, Paavola, & Lehtinen, 2004). Egocentric networks indicate what kinds of people ("alteri") a subject ("ego") knows, and tell about resource richness – how "good" the ego network is. A well developed meta-knowledge is based on these factors, that is knowledge about socially distributed knowledge sources (who knows what, how to find right people) and access to these sources (how to make contacts, what kind of prior expertise is needed).

Study 2 purports to identify changes happening in the social context while building and maintaining expert performance in the domain of human resource consultancy. The assessment of ties to the colleagues is focused on, because these are the most important indicators of high ability in this field. It is investigated how expert performance is recognized in the field, how intentionally experts build their networks and manage their social resources and how transitional periods influence personal networks.

How to assess high ability in consultancy

Besides the analysis of documents like a curriculum vitae, in which the subject wrote the most important steps in his professional career, and the study of interview data, in which the subject reported about his most important transitional periods (studies, different work places) and about the knowledge resources in general, the crucial method of assessing the interplay of individual and social attributes of high ability was based on Social Network Analysis techniques.

Social Network Analysis (SNA) questionnaire. All 18 workers of the consultant office indicated, on a scale from 0-5, how often they go asking for advice from each of their colleagues. This data set is used to create an "advice size" indicator, which shows the network pattern of mutual asking for help. Different aspects of the advice size variable, cognitive centrality and social acknowledgment of being an expert can be treated as estimates of a subject's relative importance in an organization (Burt, 1982; Krackhardt, 1990).

In previous studies (Palonen, Hakkarainen, Talvitie, & Lehtinen, 2004; Rehrl, Palonen, & Gruber, 2006), we found, however, that there are some biases related to the use of advice size measures, e.g. concerning routine coordinators (inordinately high values emerge), experts with special competencies in more obscure expert fields (too low values emerge), and social overemphasis in general. Thus, more differentiated indicators for advice size were used, including egocentric SNA measures, such as size and density of the "alteri network".

In egocentric analyses, size and density of a network are computed. Size shows the number of actors (alteri) that the analyzed subject (ego) is directly connected to. Density is the number of ties (total number of ties in the ego network), divided by the number of pairs (total number of pairs of alteri in the ego network, i.e. the number of potential ties among alteri), times 100.

The case SR

Study 2 focuses on a consultant from a consultancy office in which a total of 18 colleagues (5 males, 13 females) are working.

SR had a long and versatile career before he founded the company. He is a psychologist by education who, after a short period of work in some hospitals, turned to work in connection with working life. Now he is a senior expert (53 years, 18 years of experience in the field, 9 years in this company). He is working together with some of the most important Finnish companies, and taking part in international activities. The level of expertise is here indicated according to the reputation of the client companies.

The role of others for an expert: Being asked for advice

SR has rich connections from the past of his study and work career:

"(...) from this period [university], there are still some people I have known for a very long time and we are friends and we can deal with each others' knowledge what is going on to happen in the forest industry in Finland and in the world. From those times I worked in company XY I still have some very good friends, we are competitors, but we can discuss a

lot of the general problems of this business area and about the problems of clients and this kind of things. We in this company have quite good cooperation with some of our good competitors."

SR was highly aware of the importance of cooperation with others for the development of his career, in particular for novices:

"It has been very important for me. During my whole career I have been quite eager to build some groups, some development groups and to organize in general cooperation in professional questions. That has been very typical for me in my career. In private life I am not very social, very open, but in professional questions I have always been very active to build some kind of networks."

When SR was thinking about the most crucial tasks he had at the moment and about the processes in his work at the moment he strongly highlighted contacts with other experts outside the company as the most important information sources:

"They are outside of this list [the list provided for SNA, including the people working in the company]. They are mostly outside of this. They are some of my clients, also some of board members in our companies. But they are people who are responsible for bigger business than the business of our company. That is typical."

SR emphasized that there are many problems in which it is not possible to have expertise inside the company, and for these issues the network contacts are of great importance.

SR seemed to be very aware of the meaning of social networks for his professional development as well as for his current activity as consultant and management expert. His descriptions of social relations were differentiated and he clearly considered them crucial strategic resources for himself and for the company. In spite of being aware of his professional contacts, he did not see himself as a socially talented or active person.

The results of the egocentric network analysis confirm this description (see figure 1).

The advice size equals 53, the egocentric network size equals 19, the ego network density equals 19%. The network, to sum up, has a maximum size, but is not very dense. Case SR is asked for advice very often by other colleagues, both males (M) and females (F) as indicated in the figure 1.

Summary: The role of persons in the shadow changes during career development

The senior consultant belongs to several communities of experts. He has large external networks and specialized channels for information exchange. In contrast to the senior workers, the novices use to have rather small networks in which some actors are often more important than all others, i.e. the information channels are identical for all topics and problems. Personal networks for persons in the same environment can vary in many ways, especially as concerning to the size and heterogeneity. This indicates an access to different kinds of resources.

Interviews indicated that the experienced consultant strategically developed his practices and working habits by intentionally constructing the sources for his own professional promotion. He made use of several transition periods in order to keep access to many "exes".

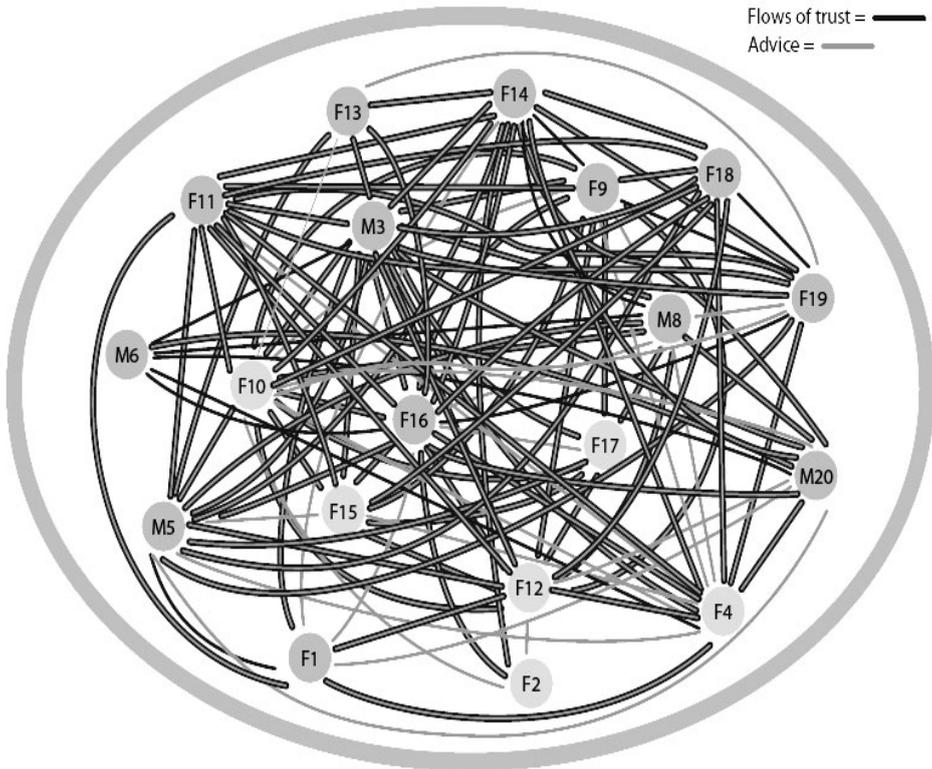


Figure 1:

Result of an egocentric network analysis of case subject SR (study 2, senior consultant)

The role of other persons thus changes during career development. In particular, during early stages, consultants could identify one or a few of the most important mentors who foster the development of high ability, because they know (and tell) exactly what to do in order to remove their "pupils" individual deficits. Thus, when aiming to identify future high ability, assessment of the quality of teachers is crucial. Pre-choices have to be taken into account, which means the processes of choosing students to run exceptional intense training with.

During later stages of development, the maintenance of regular contacts with ex-colleagues becomes more important, even if these become competitors. Knowledge exchange takes place along trusted ties. Although confidential information is not exchanged, the persons who are outside the close work environment are asked to reflect on or evaluate one's own activities.

In their personal networks, experts carry their social context with them. Not all steps and transition periods during the professional career are equally important, but the most relevant contacts are continuously activated and maintained throughout an expert's working history. In accordance with Mieg (2006), future high ability is related to early assistance from the social environment, which must be mirrored in assessments of high ability.

It is important to note that the benefits of social network ties might even be strong enough to overcome less positive individual attributes (like case subject SR's private "shyness"). This opens up an innovative field of research. So far, only little evidence exists on how patterns of relationships gradually define a person's sense of self (Ibarra, Kilduff, & Tsai, 2005). The nature of behavior in networks has a substantial potential as a component in the assessment of high ability, because it is probably highly predictive for further professional development, how professionals approach new areas of work, where and how they search for references and for literal sources, how they look for professional contacts, and so on.

Study 3: Case MS - a most successful scientist (biomedicine)

The domain: High ability in science

In science, there is only little need to negotiate standards regarding the performance and output of experts. Although most scientists labor in obscurity, a small number of them receive disproportionate recognition, which means they belong to the scientific elite that show an extraordinary output and activity. A number of theoretical concepts on professional identity in science shaped the term of the scientific elite (Kogan, 2000; Pinch, 1990; Zucker & Darby, 1996) that stress the relevance of both approaches of expertise, the individual attributes and the social embedding. In addition, performing in the context of scientific fields is part of their potential. According to a social perspective on expertise, members of a shared context nominate experts based on evaluations about the others' worth of scientific output and performance. Thus, the social attribution of expertise is independent of formal ranks but relates to social interactions within the shared community (Lang & Neyer, 2004). However, the social aspect of scientific expertise has only rarely been analyzed so far.

How to assess high ability in science

In science, one feature typical of experts in many other fields, is not well-esteemed: Constantly repeated superior performance in terms of a repetition of already known performance, regardless of the quality of the activity, is not considered to be an adequate measure of excellence because the very nature of scientific activity is to produce something new. This particular nature of science expertise constrains the use of, for example, standardized knowledge tests as a measure of high ability. Attempts to describe objective criteria for scientific expertise are problematic also because these criteria tend to emphasize individual attributes without taking into account the social and cultural nature of science. The production of scientific knowledge has gradually moved out of the private context into specific settings where the procedures, practices, and internal rules are increasingly standardized. "Institutionalization, however, served also to define who had access to these paces where scientific expertise was developed and negotiated." (Evetts, Mieg, & Felt, 2006, p. 115)

Analyses of the scientific elite indicate that social integration does not only refer to one's own group but also to larger scientific circles. The connectivity outside the group can for instance be measured through egocentric network analyses.

Social recognition and evaluation of expertise in the frames of scientific communities has several functions. It serves in classifying and comparing scientists, but also in the complex process of selection and career development of new scientists taking place in scientific communities and networks. There are many well elaborated and widely used methods to measure the excellence of institutions and individuals. Awards, invited memberships in scientific organizations and editorial boards of journals are typical measures which are based on social recognition of a person's expertise in his or her own scientific field or in the broader scientific community. It is, however, not self-evident that these nominations are always valid measures of scientific excellence. There are often other criteria than scientific excellence, which influence these nominations. When evaluating the level of his own expertise, our case subject MS pointed out that only editorial board memberships in the most prestigious, top ranked journals (e.g. *Science*, *Nature*) would be somewhat reliable measures of excellence.

The measurement of scientific publications and of their impact on the scientific community, assessed by the citations they attract has gradually become the most widely used approach for measuring the level of scientific activity. Even though citation analysis has been widely used as a measure of scientific excellence, there has been also critical discussion on the use of citation analysis to rate scientific performance. Citation counts can include negative citations (citations to incorrect results), self-citations (citations to the works of the citing authors), or some other features which are not necessarily indicators of scientific quality (Garfield, 1978). So called citation networks refer to groups of scientist who tend to cite each others' work (Lehmann, Lautrup, & Jackson, 2003; Palonen & Lehtinen, 2001). Despite all the limitations, there is plenty of empirical evidence supporting the use of citations as a measure of scientific excellence (Bornmann & Daniel, 2006).

The case subject MS

The case subject MS is a professor in the faculty of medicine in a Finnish university, since 1995. In his own field he is the leading researcher in the country and one of the internationally best known scientists in his own university.

In the interview MS emphasized that it is important in which kind of journals the papers are published and what is their impact in the field. "I think that citations can reflect the importance of the publications. Of course these go hand in hand. It is easier to get citations if a paper is published in a highly respected journal." He expressed that, in general, citations are a valid indicator of the level of expertise within one's own field. If the aim is to assess the current level of expertise and to anticipate future achievement (for example, for evaluation of research funding proposals) only the recent citations, from the last five or ten years, are relevant.

MS has almost 300 original articles published in international peer-reviewed journals. Some of them have been published in the most prestigious top journals such as *Science*. These articles have about 5000 citations (ISI, Web of Science).

Encouraging supervisors: Persons in the shadow in the beginning of the career

MS graduated in medicine in 1977. After acting a year as a practicing doctor, he returned to the university and started his scientific career. There was an opening in the department, an opportunity for a new doctoral student. He contacted the professor, who knew him from before, and got the position. The model of doctoral studies was very traditional; the professor gave a topic which was unrelated and unfunded. It meant individual and isolated work with the Ph.D. project. During the first step of his scientific career, his own professor EI was the most important contact. EI had recognized him as a promising researcher and opened him access to scientific life. The professor was very supportive on a general level, but his own research was not adequate for MS, because it was technically a little outdated. However, the personal support and encouragement given by EI was important. Even more important was that professor EI helped MS to get contact with the second important supervisor in the U.S.

After two years of work as a doctoral student something happened which had decisive meaning for the later career of MS. A successful young Finnish researcher, Dr. ML, had started his own group in the U.S. in the National Institute of Mental Health and contacted Finnish professors in the field and asked if they had a promising young researcher who could start as research fellow in the group. MS got this message from his supervisor EI, applied to the position and was selected. This selection was mainly based on the informal letter describing the motivation for application and personal recommendations given by his Finnish professor.

Because of these new opportunities, he abandoned his original Ph.D. project and started a new research field together with ML. This two-year period in the institution was very intensive and productive. MS published circa 20 papers together with his supervisor ML. They were working in the laboratory and got molecular samples with the help of ML's extensive scientific networks. The opportunity to work as a younger colleague of a very ambitious, dynamic and internationally well established researcher gave excellent opportunities and standards for MS's future work as a scientist. At that time NIH was very popular, and they were used to receiving visitors from abroad. The organization and environment was therefore well prepared to welcome the young scientist.

Deliberate practice through networking with persons in the shadow

In NIH, not only one person (ML) influenced MS's work, but the whole scientific environment was very important.

"There were tens and tens of researchers I got to know during my stay in the institute and many of those younger people who have later founded their own laboratories and research groups in different universities are still important colleagues for me (e.g. WP, SP, TI and EM). There is still some exchange with these people but not active collaboration any more."

MS can, however, contact these people any time if he needs some specific information or piece of advice.

MS said that he made use of the opportunities at NIH and actively created new contacts with permanent staff and visiting researchers. His networking activities at that time were already somewhat intentional, if not systematically planned.

"Maybe I did it more than other young fellows but there were no restrictions for networking."

He was curious to know what different researchers were doing in different research groups, but in addition to that he wanted to get specific help and to learn new methods and technologies with the help of these network contacts. In that context, even a young unknown researcher had the opportunity to get contact with well known experts. This was a normal part of the culture in the institute that young visiting researchers had these networking opportunities. In addition to the people who worked in the institute, it was an excellent place to learn "meta-knowledge" about the field: Who knows what? Who is doing what in the field mainly in North America?

In the institute, there was a continuous evaluation and selection process going on. It attracted young researchers from all over the world. They were all supported in their research projects but at the same time they were very carefully evaluated by the senior researchers. A few of the young fellows got an offer to stay in the institution after the fellow period was over. It would have been possible for MS to stay in the institute but for family reasons he decided to return to Finland.

Professor EI was again very supportive and helped MS in settling down in a Finnish university. Very soon he finished his Ph.D. in 1984. One of the external reviewers of the Ph.D. thesis was professor LB from the famous Karolinska Institutet (Sweden), a friend and colleague of his former supervisor (ML) in NIH. The nomination of this particular reviewer was based on these contacts. The thesis got high grades and, in addition, MS was informally assessed as a promising researcher by the Swedish reviewer. MS was invited to work as a visiting clinical and research associate in the Karolinska Institutet with LB for four months.

"This was also a very important period for my development. Dr. LB and his boss professor FS, who can be considered as the founding father of the modern version of my research field in Europe, opened for me an excellent access to the European research networks."

Very soon after he had finished his Ph.D. and the research period in Sweden, MS was nominated as an acting professor at a Finnish university. At 1989 he got extensive research funding from the Academy of Finland and the Research Agency for Innovations and Technology in Finland (TEKES). This funding is based on competition and international peer review. That period opened for him new important contacts with people working in research and development in the pharmacy industry. The long lasting funding from the Technology Funding Agency was possible because of these new contacts, particularly the contacts with Dr. LA. At that time, MS also extended his international networks. Very important contacts were established during a one year period as Visiting Scientist in the Laboratory of Dr. RL in Duke University Medical Center, 1991-1992.

Maintaining contact with persons in the shadow: Reciprocal collaboration and desired network partners

"The famous international supervisors and early collaborators I had, have given my work credibility and helped me to get new contacts elsewhere."

With the help of his international networks it was possible for him to start, as the first researcher, a new molecular and cell biology based research tradition in Finnish pharmacology. In developing these new methods, his contacts to some of the top groups in the U.S.

were crucial. The year in the U.S. was very important for creating new networks which were very influential in directing his and his research team's work to the trajectory they are still following.

The nature of MS's network contacts changed during the development of his career. Because of the reputation of his work and the numerous international publications, as well as the joint publications with eminent researchers, it became possible to start reciprocal and equal collaboration with established senior scientists in his field. Nowadays, he is also frequently contacted by other researchers from all over the world who want to collaborate with him. At the moment he is in a position in which he, in turn, has to evaluate how promising possible collaborators these people are.

Continuous learning in a scientific community

According to MS, during his whole career, referee comments from journals have been helpful for learning what the journals want and how the results should be presented so that also other people can understand them. Collaborative writing with many colleagues has been important for learning different writing styles.

The attempts to get network contacts from the beginning of the career have been a fundamental part of the professional development of MS.

"It was not random and it was not planned, it was more intuitive. It was somehow clear for me that I have to go and learn from other people and not to try to learn everything by myself. Now I have much more specific plans for contacts. Information is now so much easier to obtain. With the help of the Internet you can find out what other researchers are doing and you don't have to wait for the publications. Publications are still important in addition to the conferences and other methods. Still, there is a lack between the real work and publications. If I want to apply new technologies it is important to exchange experiences with the colleagues in the same field."

MS was also very aware of the importance of meta-knowledge of the scientific community in his field. That means to be well informed about the important research groups, the work they are doing and the methods they are applying.

"It [meta-knowledge] has largely developed through my stay in different places abroad. There I really learned to know the people, where they are and what they do. An important place to learn meta-knowledge about my own research field is the large world congress and there a special section in my own research field. Regular participation in these sessions and active role in organizing different activities in the frames of that conference have been important for creating and updating the meta-knowledge in my field."

All important contacts of MS have not been intentional from the beginning. There are also many random or occasional meetings with other researchers which have proved to be important for his work.

"I can remember occasions where I have met people from other fields and discussions with them have helped me in solving problems in my own research. I am of the opinion that scientists should have quite a broad education and interests in order to be able to discuss with people from other fields and to learn from them through analogies."

A methodological tool: Timeline approach

We drew MS's most important transition steps which at the same time have re-organized his social context and most important network contacts on a timeline (see figure 2). Yet, there is no strong evidence whether expert performance in various domains could be seen as a distinctive age curve with single peak and mid-career optimum, or if the curve is domain-specific and what kind of post-peak decline can be found (Simonton, 2006).

General conclusions

In line with Ericsson et al. (2007) we argue that "traditional" research on high ability is frequently confronted with one basic problem: We cannot gain empirical data of innate predisposition and capacities. The predictive strength of aptitude tests in general is thus weak. Instead, we presented an approach on how to assess high ability, based on research of expertise. We argued that both the analysis of (a) individual strengths and of regular patterns of (deliberate) practice, and (b) the formation of one's position in social networks is required. The connecting entity between both parts of high ability are "persons in the shadow", i.e. other parties who direct the individual's development, design and monitor practice activities, facilitate the acquisition and application of knowledge and skills, and so on. The analysis of such persons in the shadow in accordance with the individuals' strengths and their social networks forms a promising attempt to assess high ability and to predict future professional development.

In three case studies from different professions, we illustrated which methodologies are appropriate for such assessment attempts, and what kind of evidence can be expected from them. The domains selected for the case studies were deliberately different. Jazz musicians typically perform individually or in small ensembles. They usually have only a few influential persons in the shadow, and these frequently are not even bodily present but act through media, such as recordings. In contrast, human resource consultants typically perform in teams, the professional network being a crucial component of high ability performance. The subjects' individual excellence is of less importance, because professional knowledge management systems are available and different roles in the network are legitimate and required. Very often, the members in the group mutually act as persons in the shadow for each other. In science, more precisely in biomedicine, individual excellence is present, but is embedded in huge social networks (of citation, recommendation, appreciation, and so on). Persons in the shadow usually play a crucial role for the advancement of one's professional career, typically because they are gate-keepers which connect individuals to other professional networks than the current one. Such shadow relationships are maintained and even extended through the whole life career.

Our three case studies exemplify ways of how to assess high ability from the theoretical conception outlined. Each included the analysis of practice variables, the gathering of data about subjects' apprenticeship years, and, through social network analyses, criteria like success in mastering critical changes or transitional periods in the career and creation of important social network ties, choices of persons in the shadow and these persons' willingness to bring their resources into laborious training activities that would characterize the future experts at an early stage.

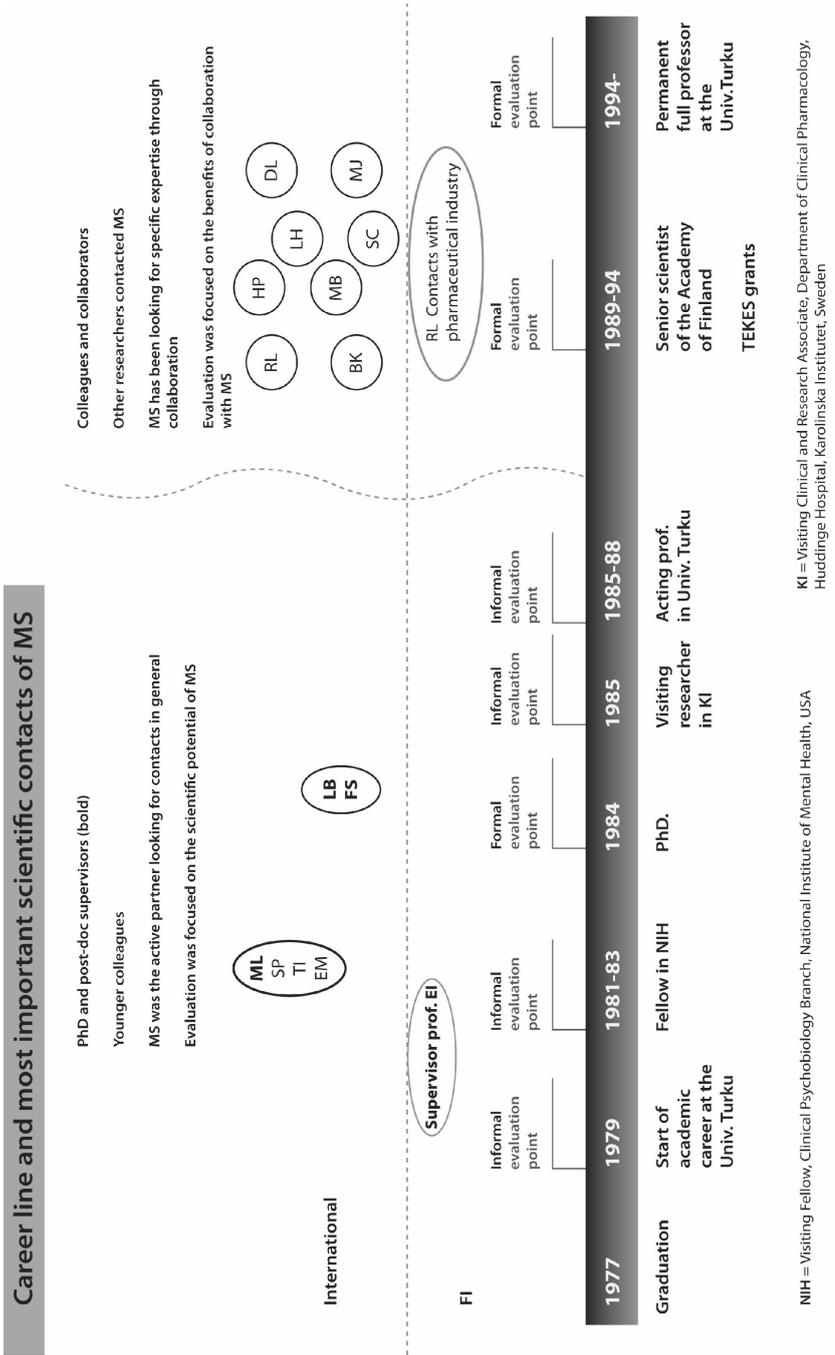


Figure 2: Timeline approach to reconstruct case subject MS's (study 3) most important transition steps during his scientific career, concerning the most important network contacts

Our findings confirm those of earlier studies (Sosniak, 2006), in which individuals were encouraged and supported continuously over time. Expectations have been put and reached, step by step, in various fields, communities and networks, by the whole range of different supervisors, teachers and colleagues. In addition to intentional and deliberate practice, excellent performance takes an enormous amount of support given by the social context. Differences between domains show that the importance of persons in the shadow for experts' practice and development can have very different faces. The assessment of high ability thus is far from being an easy job, because intensive analyses of the nature of the domain are required. We are confident, however, that these efforts are rewarding in order to better understand how high ability in complex professional domains develops.

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